

Engagement of Native American Tribes in the determination of legacy and emerging PAH dietary exposure scenarios, assessment of possible risks to human health



Norman Forsberg, Dave Stone, Anna Harding, Barbara Harper, Stuart Harris, Melissa M. Matzke, Andres Cardenas, Katrina M. Waters, Kim A. Anderson

Material & data-sharing agreement

- Collaborative determination of:
 - Research aims
 - Data collection, analysis, validation
 - Data interpretation
 - Publication options
 - Data ownership
- Harding, A, et al. 2012. Conducting research with tribal communities: Sovereignty, ethics, and data-sharing issues. *EHP* 120(1): 6-10.



Study objectives

1. Characterize the effect of CTUIR smoking method on polycyclic aromatic hydrocarbon (PAH) content in smoked salmon
2. Compare traditionally smoked salmon PAH levels to PAHs in commercially smoked salmon.
3. Estimate potential risks from consumption of traditionally smoked salmon.

Study design

- Two-factors considered
 - Smoking structure (tipi or smoked shed)
 - Wood type (apple or alder)
- Non-smoked salmon control
- Smoked salmon prepared as if to be eaten!
- 3 different commercial smoked salmon

Study execution – salmon preparation

- 20 spring Chinook salmon (May 15, 2011)
- Salmon filleted at CTUIR immediately prior to smoking and stored at 4.5°C.
- No brine or liquid smoke used



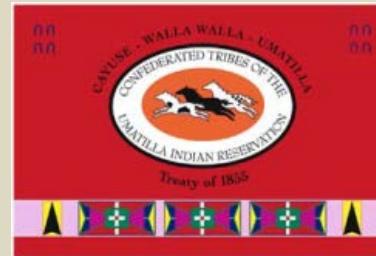
Study execution – salmon smoking

- 10 non-smoked sub- samples/event
→ -10°C
- 10 fillets/ smoking method
- Apple wood followed by alder wood



Study execution – post smoking

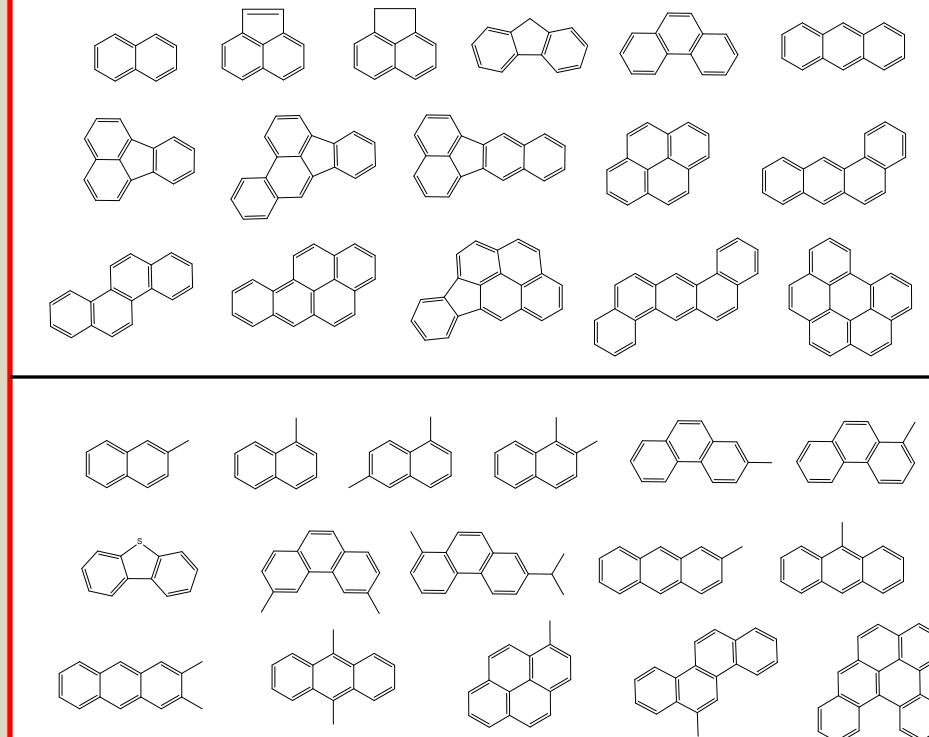
- Fillets into amber glass jars
- Immediately stored at -10°C
- Transported on ice to OSU Food Safety and Environmental Stewardship Laboratory (-20°C).



Salmon chemical analysis

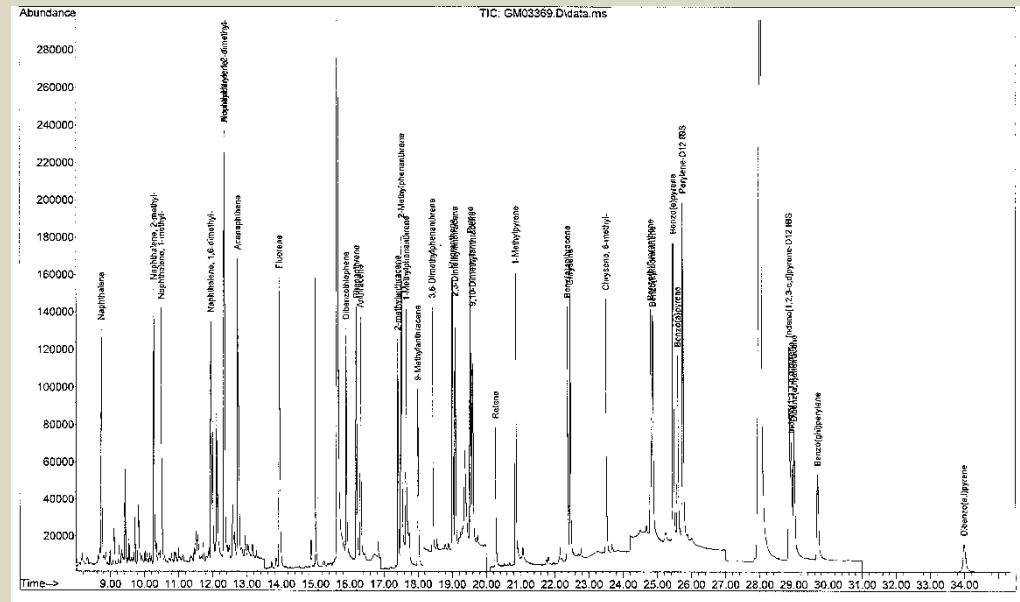
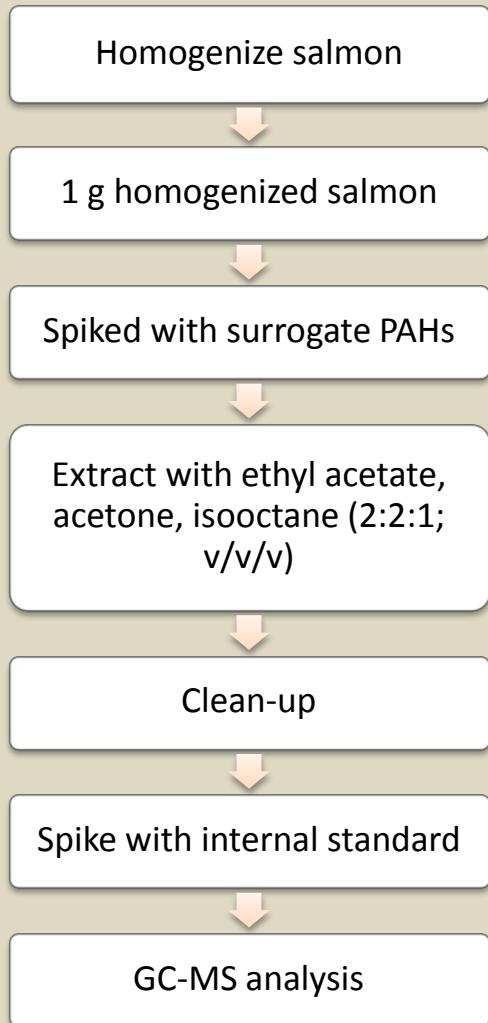
- 33 PAHs analyzed
- Validated analytical method (Forsberg et al., 2011)
- Reporting limits < 10 µg kg⁻¹
- Quality control
 - Method blanks, matrix over-spikes, extraction duplicates, instrument blanks, continuing calibration and verifications

Legacy and emerging PAHs

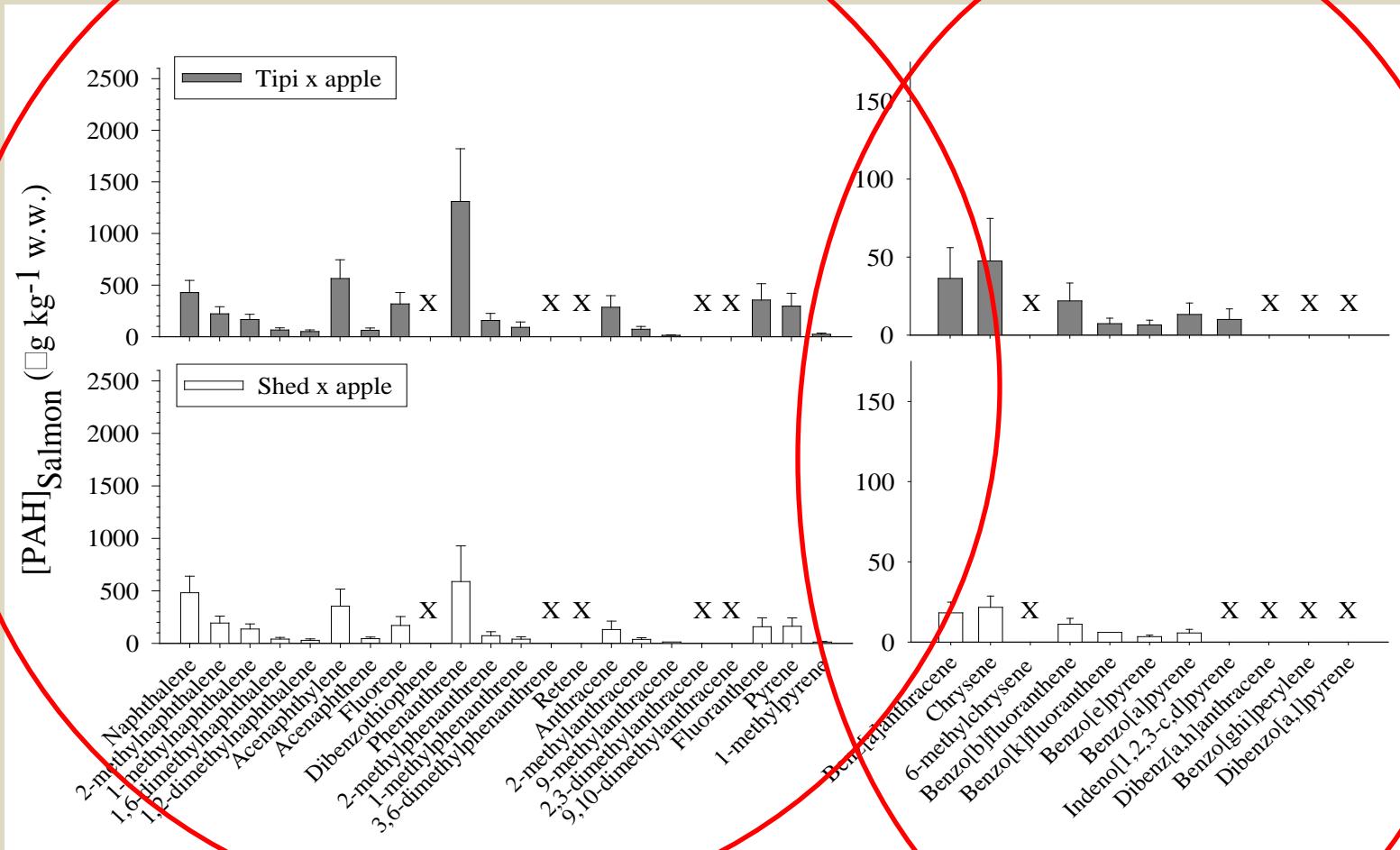


Chemical analysis flowchart

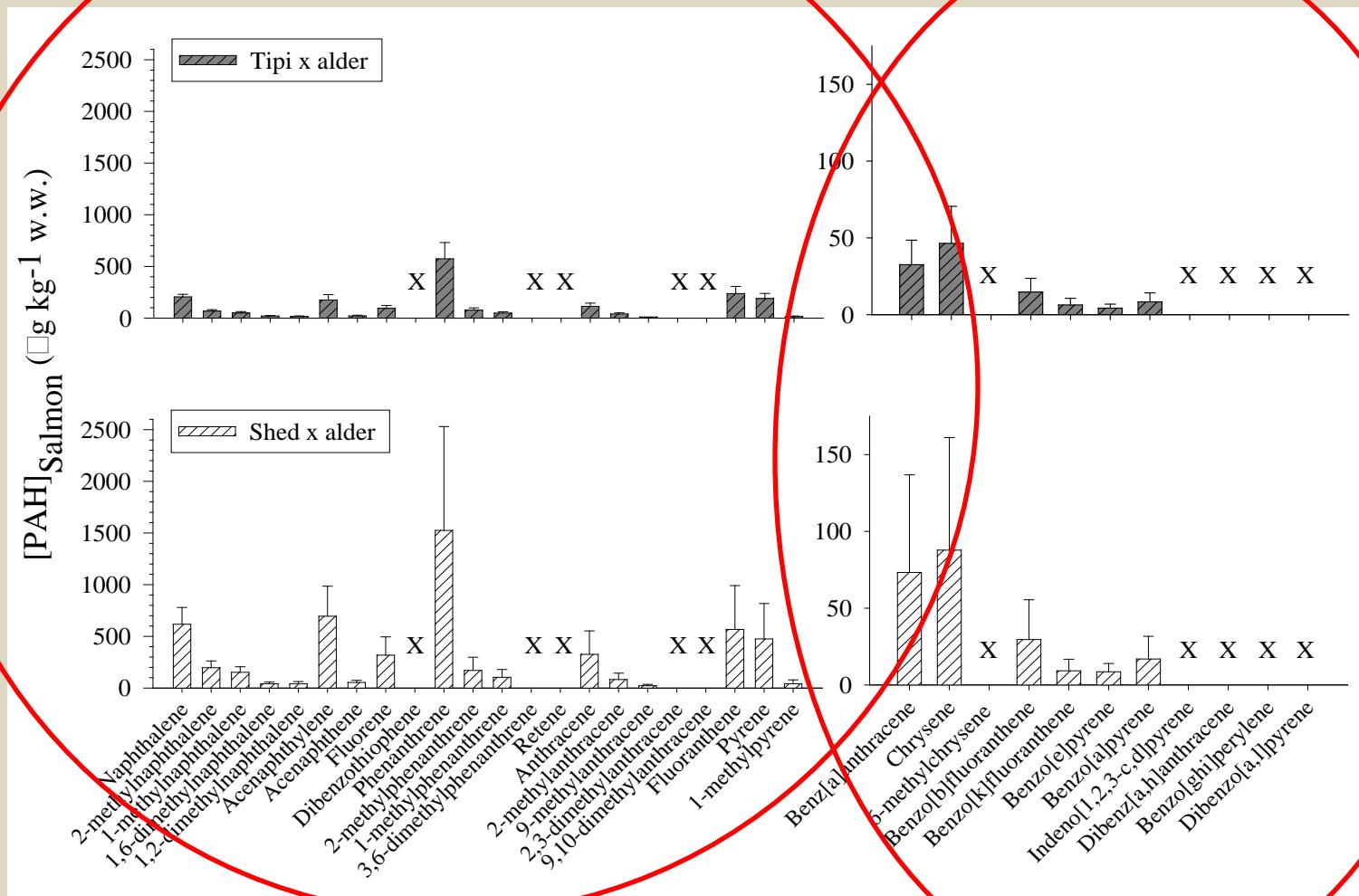
Salmon chemical analysis



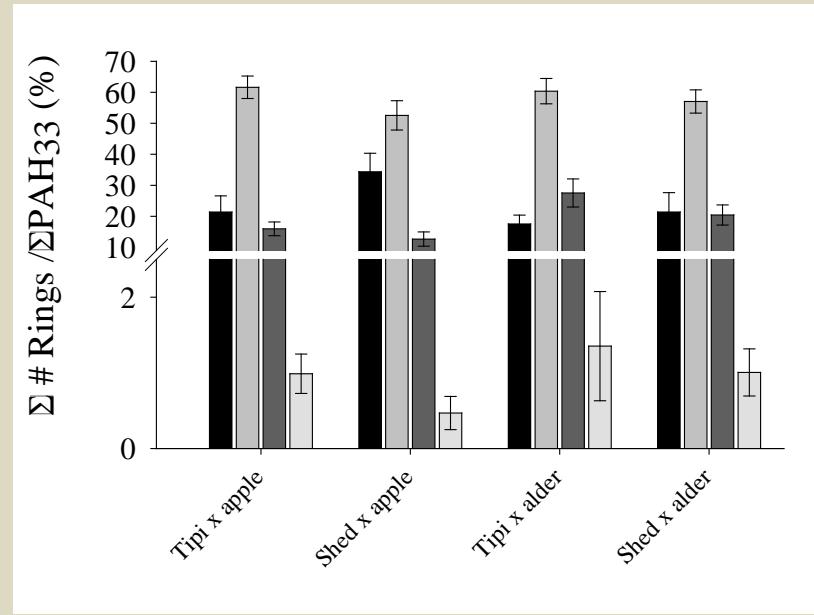
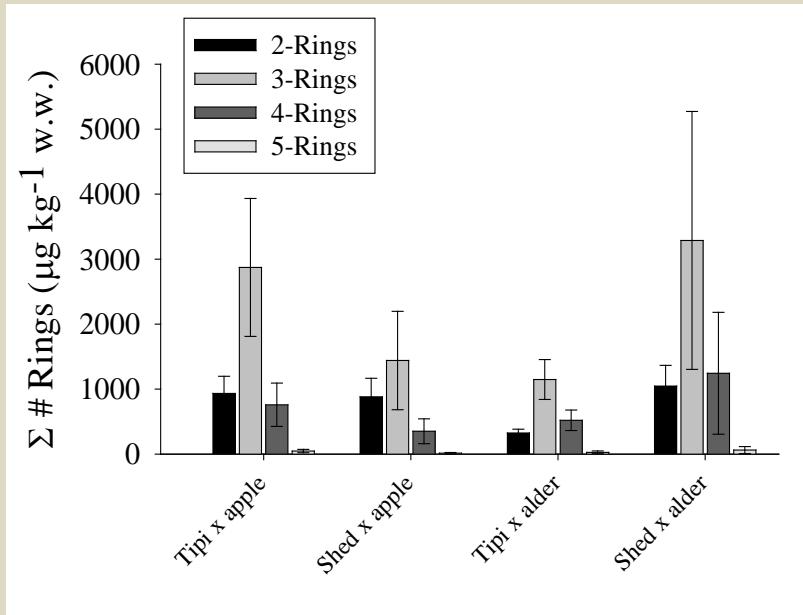
Study results – PAH content in apple wood smoked salmon



PAH content in alder wood smoked salmon

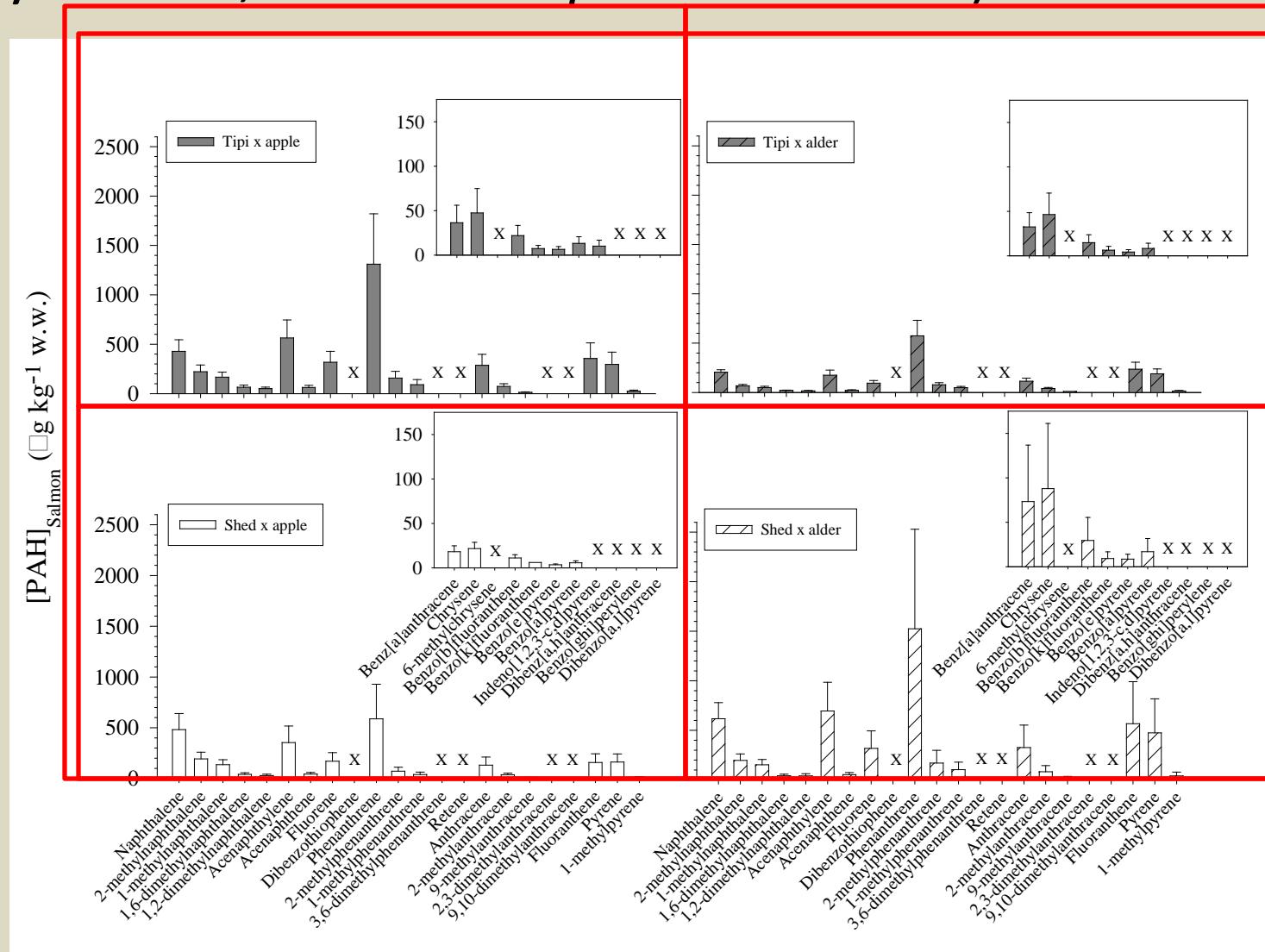


Categorized PAH abundances



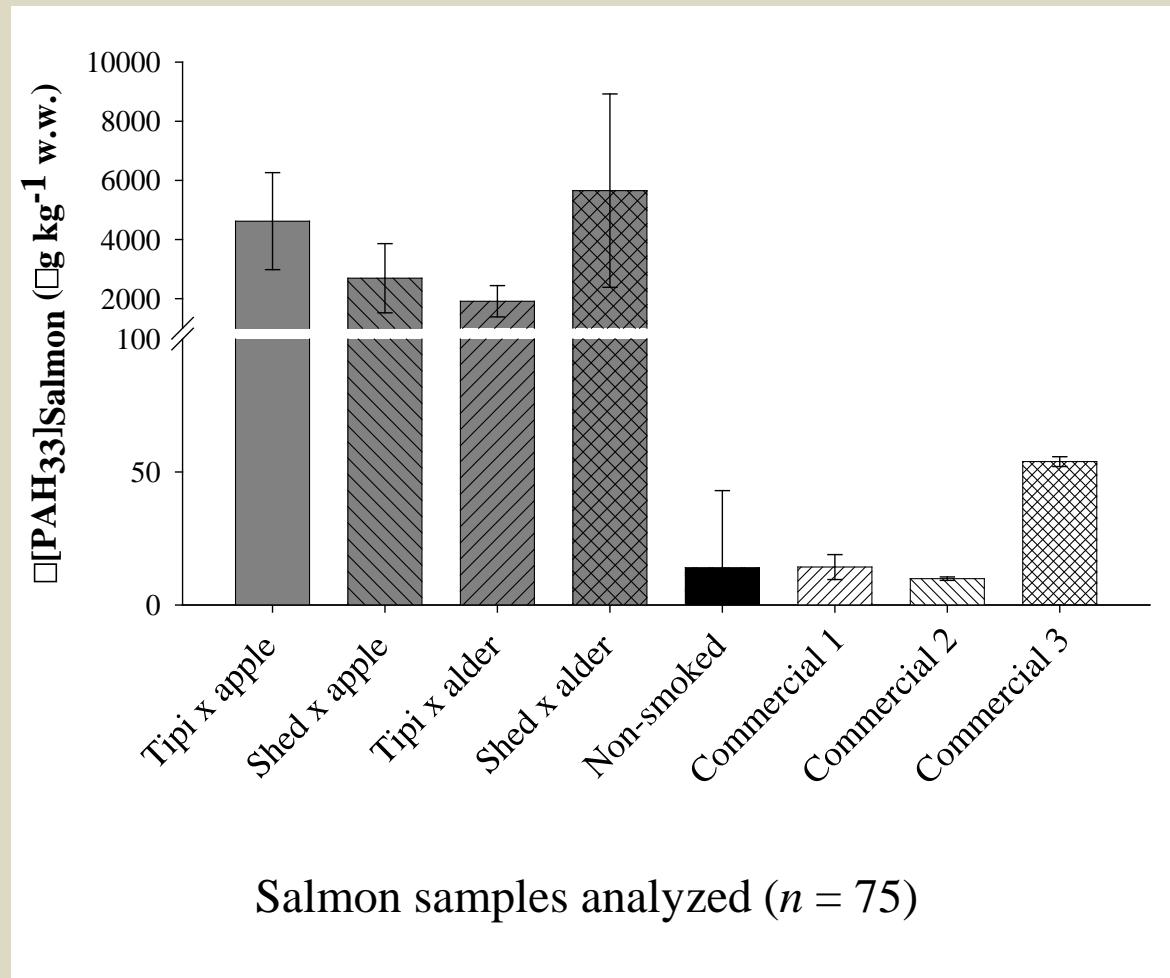
- PAHs by number of rings: $3 > 2 \approx 4 > 5$
- Legacy PAHs $\sim 80\%$, emerging PAHs $\sim 20\%$
- Non-carcinogenic $\sim 90\%$, carcinogenic $\sim 10\%$

Study results – no treatment related effect (two-way ANOVA, interaction p-value < 0.001)

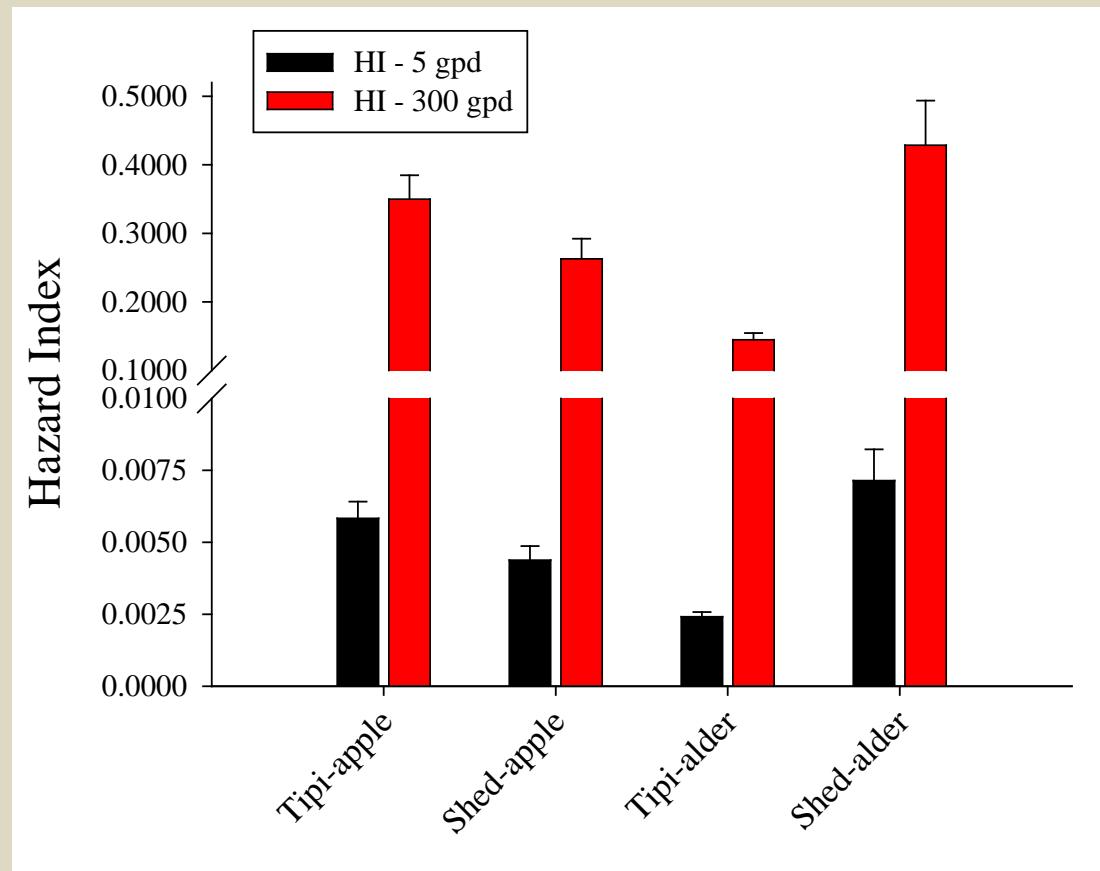


PAHs measured in CTUIR smoked salmon vs commercial smoked salmon

- PAH levels were $\times 140 - 430$ in CTUIR smoked salmon
- Σ PAH levels in commercial smoked salmon similar to non-smoked CTUIR salmon

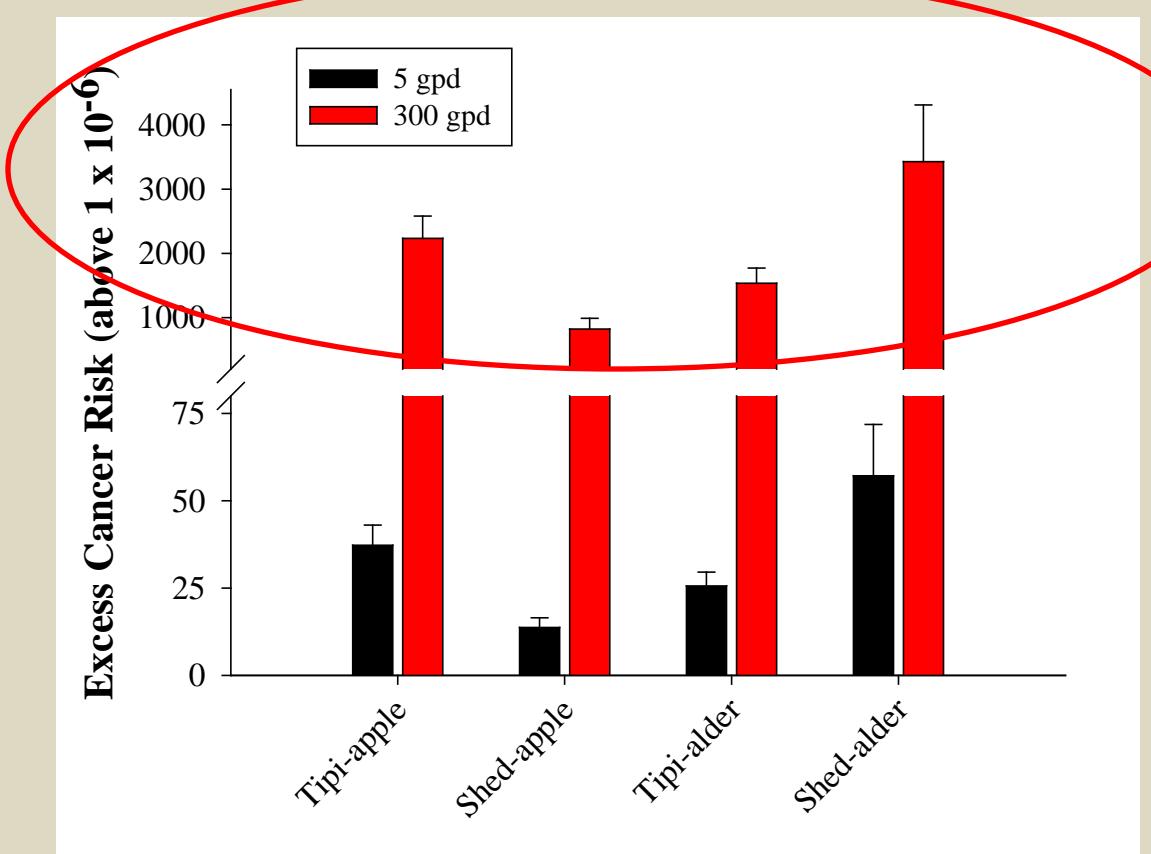


Estimated hazard indexes resulting from low and high rates of smoked salmon ingestion (mean \pm SEM, $n = 10$)



Estimated cancer risks resulting from low and high rates of smoked salmon ingestion (mean \pm SEM, $n = 10$)

- All scenarios generated cancer risks $> 1 \times 10^{-6}$



Questions?